IMPROVING MUNICIPAL CASH FLOW – SYSTEMATIC LAND INFORMATION MANAGEMENT

Ian CORKER, United Kingdom and Jukka NIEMINEN, Finland

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ABSTRACT

Finance concerns city managers. The municipal income is often insufficient to maintain infrastructure. The poor suffer most from inadequate municipal finance.

City managers have various sources of income, but property tax has certain advantages:
- Tax is based on property, which cannot be hidden
- Unpaid tax is charged against the property, which can be sold to recover the tax.
- Income from property tax is certain.
- Link between property value and wealth is relatively direct.
- Tax GIS map data can be used by others: public utilities, census, election area definitions etc.

Despite advantages, property tax systems are often inefficient, out-of-date and fail to produce.
Reasons:
- Property tax is based on cumbersome and irrelevant colonial systems.
- Assessment of taxable values requires highly skilled valuers.
- System is unable to cope with changes during periods of high inflation
- Cost of collecting tax sometimes exceeds the value of tax collected.

Result:
- Property tax systems either stopped, or became minor sources of municipal income.

Aerial photography, satellite imagery and GIS allow property taxation to be efficient and fair form of municipal income.

Orthophotomaps and high-resolution satellite show all buildings at given date. Digitising building boundaries produces maps of taxable properties. Combining digitised images with ground truthing produces an up-to-date taxation list. Combined with computer finance it provides simple, effective taxation system.

Information for property taxation has other uses. Taxation map is the first step in determining land rights. Aerial photographs provide information for planning. Data give basic information for utility providers.

Remote sensing and simple survey are cost effective. The whole system can be developed using quick commercial loans, with cost recovered from increased income.

BACKGROUND

The amount of property collected can be described by the formula[i ii]:

Tax Revenue = Tax Base * TR * CVR * VR * CLR

Definitions used in this tax revenue model are as follows:

Tax Base **Tax Base** is defined according to the government policy in terms of what is and what is not taxed, typically the value of that base under an ad valorem tax system.[iii]

TR **Tax Rate** is defined as the "rate struck" for the taxing jurisdiction, measuring the tax amount per value of the property that is to be paid as tax. The tax ratio (or tax rate) is normally determined through the annual budget process.[iv]

CVR **Coverage Ratio** is defined as the amount of taxable property captured in the fiscal cadastre, divided by the total taxable property in a jurisdiction, measuring the accuracy and completeness of the valuation roll information.

VR **Valuation Ratio** is defined as the value on the valuation rolls divided by the real market value of properties on the valuation roll. This measures the accuracy of the property valuation level..[v]

CLR **Collection Ratio** is defined as the tax revenue collected over the total tax liability billed for that year, measuring the collection efficiency. The collection ratio is affected by the collection of both current liability and tax arrears.[vi]

In many countries the actual tax revenue is far lower than the potential tax revenue. Reasons include:

Tax Base Many properties have been exempted from the tax base, especially government buildings.

Tax Rate The Tax Rate should be changed regularly to keep pace with increasing municipal expenditure. For political reasons tax rates may be kept low. As a result municipal incomes soon fall short of expenditure. The correction needed is more difficult and thus does not happen. The situation is made worse by other factors such as rapid inflation.

Coverage Ratio The property tax system was often established in the colonial era. Inclusion in the property list required properties to meet certain criteria, such as being registered or being of a certain standard. In rapidly

growing cities many new properties were not included in the lists, resulting in reduced coverage ratios.

Valuation Ratio Most property taxation systems use either rental or capital values as the basis for taxation. With inflation actual values and assessed values soon become separated. Thus requiring either a valuation to an agreed base date, or regular revaluations. In many countries there is no real open market (communist or socialist states and countries where property is not sold but passed to the family). Determination of value is very difficult and requires highly trained valuers.

Collection Ratio Avoidance of taxes is universal and unless there is an efficient system of issuing tax demands and receiving income and chasing arrears, low collection ratios are inevitable.

IMPROVING TAX COLLECTION

In many developing and emerging countries the property tax system suffers from many of the problems outlined above. This results in tax revenues being much lower than the potential would suggest. How can this situation be reversed?

Tax Base The tax base should be as wide as possible. The provision of exemptions is a matter of policy and economics. Where exemptions are made care needs to be taken to ensure that the system is not abused.[vii]

Tax Rate The tax ratio should be sufficient for the municipality to provide the municipality with the income it requires from property taxation. Increasing the rate to provide realistic levels of income is necessary if property tax is to be a viable source of municipal finance.

Coverage Ratio The aim should be to account for all properties in the valuation list, 100% coverage ratio. The problem is that maps are out of date before they are published, making it difficult to determine where all taxable units are. The use of aerial photographs (orthophotomaps, Gaza City, Palestine) or satellite images is one method of determining all properties at a given date in the recent past, although similar results can be obtained by careful systematic ground surveys, as well (Kanpur, India). The method selected depends on the relative costs of remote sensing versus ground survey, as well as any restrictions on the use of aerial surveys or satellite imagery (usually from the military).

To achieve a high coverage ratio any unnecessary restrictions or procedures should be removed. This may require changes to administrative instructions or laws. Such changes require both political commitment and time.

Ensuring that there is 100% cover requires both a comprehensive map and database of tax-payers and their properties.

The most basic check is to determine the property tax status of all the land and properties. Only two states should be permitted: taxable and none taxable.

Valuation Ratio Value is used as a basis for tax because people with similar valued properties should pay similar tax rates. The important point is the comparison between properties. Rather than use value it is possible to simply use some form of comparative index. The simplest would be to use: Size, Use and Location.

Size and use are simple, while the effects of location would require a valuer to determine the boundaries of areas having broadly similar property values. The location boundaries and the relative effects can be determined in conjunction with the planning system so as to influence different types of development.

In this model condition of the property has not been included. This is both to keep the model as simple as possible, but also because there is an argument that owners who maintain their property should not be taxed more because of it.

Example

Property tax rates for two areas of Gaza City, one a high value residential area with hotels and embassies, the other a mainly industrial and low income housing area.

	High Value Residential	**Industrial and Low income Housing**
Base Property Value index	1000	200
Use factors		
Residential	1	1
Industrial	2	1
Shops	1.5	1
Offices	1.5	2
Hotel	1	2

The effects on the tax base can be seen by comparing similarly sized apartments, factories and hotels in the two areas:

	High Value Residential	**Industrial and Low income Housing**
Apartment 125 sq m	1000*125*1=125,000	200*125*1=25,000
Factory 500 sq m	1000*500*2=1,000,000	200*500*1=100,000
Hotel 600 sq m	1000*600*1=600,000	200*600*2=240,000

Not only is determination of the tax base simple, but the ratio of tax bases for similar sized properties in the same use shows how the system can be used to influence location decisions via the taxation system.

Collection Ratio The aim should be to collect 100% of the tax owed, but in reality this is not possible. People die, move away or their property is destroyed or abandoned. There will also be cases of genuine distress and hardship, where pursuit of the full tax owning is not justified. Where a culture of non payment has developed over the years it would be unrealistic to expect this to change overnight, and even if debts are pursued through the courts it can take months or years for the matter to be determined, even then the money owed may not be recovered.

This is not to argue that no attempt should be made to collect all of the tax owed, but rather to explain that high collection ratios cannot be expected overnight.

SYSTEMATIC LAND INFORMATION MANAGEMENT

The individual information used in property taxation is not particularly complicated:

Property
- type
- size
- condition
- use
- location

Individual
- liability to tax
- name
- address
- reason for exemption (if any)

But even a small urban area will have thousands of properties, while a large metropolitan area, such as HoChiMinh City (Saigon) will have over a million properties. Even in a stable society the details of these properties is constantly changing: people die and property is pass to their heirs or becomes abandoned; the use changes; properties change hands, are subdivided and amalgamated; old properties are demolished and new ones built. If it is not to become out of date any property taxation system must be able to deal with these changes.

Systematic Land Information Management (SLIM) was developed to provide up to date information on properties and then maintain this data.

SLIM was originally conceived while using orthophotomaps for land registration in the Palestine Authority Territories. Although the work on land registration used high-resolution (15 cm) aerial photographs, converted into orthophotomaps, the project had obtained low-resolution (1.25 m) orthophotomaps of Gaza City. Despite the low resolution, it was possible to identify most of the buildings and to make estimates of the footprint area of the larger properties. At 1.25 m the resolution of the orthophotomaps was lower (worse) than modern high-resolution satellite imagery (1.0m black and white IKONOS). If low resolution orthophotomaps or 1 m satellite images can be used to identify properties then they can be used to produce up to date maps of taxable units.

Using the orthophotomaps as a base it should be possible to produce an accurate and up to date map of all taxable units in a city. Using this as a base the properties can be ground truthed to provide information such as use, condition type of materials etc as well as details or the owner and/or occupier.

All of this information can be held on a Geographical Information System, giving easy access to the information needed to determine property tax.

Linking this GIS data with an accounts package, capable of issuing bills, receiving income and managing arrears, produces the Systematic Land Information Management system needed to manage property taxation.

Digital Orhtophoto approach (Gaza, Palestine)

In 1998 the Finnish Government financed the Palestine Finland Land Management Project to assist the Palestinian Authority register some 7,000 ha in the Gaza Strip. This was land that was not registered during the British Mandate because it was then occupied by Bedouins, whose land tenure system did not fit the British model of individual ownership.

A major constraint on registration was the time and cost of conventional survey methods, using total stations and other terrestrial survey methods. One of the important factors in what survey methods could be used was the fact that under the land registration law in Palestine the boundaries on the land registration map are General Boundaries. The most important point about General Boundaries is that the boundaries shown on the map only indicate the approximate location of the actual boundaries on the ground. As the map boundaries are indicative, not definitive, they do not have to be defined precisely. In addition, most of the lands being registered were agricultural and they were normally bounded with physical features, such as hedges, fences tracks and roads.

It was therefore decided that rather than use conventional surveys the boundaries would be determined using orthophotomaps.

The project area was flown at a scale of 1:5,500. An attempt was made to premark the area, but many of the marks were removed before the flight. Rectification therefore required

determining the location of other visible features. Rectification to a coordinate system and grid also proved to be a challenge. Gaza was originally covered by the Palestinian Grid, established in 1922 by the British Military Survey. But by 1998 most of the control points had been lost or deliberately destroyed. Israel had established a new grid, but obtaining precise information was very difficult and Palestinian surveyors were not allowed access to the control points in Israel. It was therefore decided to establish a new grid and control system. The new grid and control system was established jointly by the Finnish Ministry for Foreign Affairs and the British Department for International Development (DFID). Britain provided expertise, from Ordnance Survey and Finland provided equipment and logistics.

Once the new control system was established the control points used to rectify the orthophotographs were surveyed using GPS. The orthophotographs were produced at a resolution of 20cm.

Determination and survey of parcel boundaries was undertaken by private surveyors on contract to the Project, with their work being checked by the Ministry of Housing Survey Department. The procedure for surveying boundaries was:

- Notification of intention to register land, issued by Commissioner of Lands and advertised in newspapers according to the Land Registration Law.
- Appointed surveyor makes public his intention to start work and requests that people claiming land mark the boundaries they claim. The surveyor issues flagging (coloured tape) to facilitate differentiation of boundaries.
- If boundaries between claimants are different the surveyor asks adjacent claimants to try and resolve their differences.
- If differences cannot be resolved by claimants, the matter is passed to the Local Land Committee (a group of village elders).
- If dispute still not resolved or already a matter for legal action, the matter is sent to court.
- Surveyor makes the demarcated boundary on a paper copy of the orthophotomap, using visible features to help.
- The field copy of the boundaries is digitised to produce a shape file of parcels.
- Attribute files are crated comprising:
    - unique parcel number
    - name of claimant
    - interest claimed
    - other information
- A provisional map of parcels and claimants produced and advertised as “Schedule of Claims”.
- If no objections within the statutory period the parcel is passed to the Schedule of Rights.

- If objections are made the Commissioner of Lands hears the objections and determines ownership and boundaries, his decision passes to the Schedule of Rights.
- The Schedule of Rights is passed to the Registrar of Lands, who registers the parcel and the rights of the owner and issues the owner with a Land Certificate

Due to administrative and political difficulties, especially the selection of a suitable Commissioner of Lands, work on survey of parcels did not start until the last three months, but once started it progressed rapidly. This Phase ended in January 2000 and a second Phase was being considered, but the Intifada in September 2000 suspended approval of Phase 2. However, in recent visits, the latest in August 2001, it was found that work on registration in Gaza is still continuing. The PNA is financing the work by charging a modest fee for surveys. Significantly the work to date, even though it has not yet resulted in full registration, has produced significant increases in land values. Prior to starting the project prices were around four Jordanian Dinars per square metre, but after survey and issuing of the Certificate of Rights, prices have more than doubled. This is even more impressive, given that the land is close to Israeli Settlements and the surveyors and land owners have been shot at by settlers.

Manual SLIM Approach (Kanpur, India)

Despite the advantages of orthophotomaps or satellite images as a base for property tax assessment, they are not always suitable. In some countries or cities remote sensed data is not allowed for strategic reasons, while in others obtaining information using manual surveys is less expensive than is the use of remote sensing.

Kanpur City is located in the State of Uttar Pradesh in India. The total land area of Kanpur is about 340 sq. km, and the population is about 2.8-3.0 million. One of the main problems of the Kanpur Nagar Nigam (City Corporation) and Kanpur Jal Sansthan (Kanpur Water Company) has been the extremely low tax revenues. The year 1999-2000 annual budget for KNN was about USD 18 million and the KNN tax revenues collected were about USD 3,45 million totalling only 18 per cent of the total budget.

As part of the Dutch Government supported Institution and Community Development Project (ICDP 1995-1998 and ICDP2 1998-2001) also the possibilities to find a solution for an improved tax revenue collection was sought. The major problems in Kanpur were as follows:

- A new ACCESS based tax collection and billing system was installed quite recently and kept changing constantly, as new features were demanded from the KNN/KJS side
- The ACCESS based tax billing system had no consistency checks to prevent false information entry

- The KNN and KJS tax collection databases had a different number of tax paying units and even different names of owners on the same piece of property though originally both were using the same master database and list of properties
- Nobody really knows how many taxable property units there are in Kanpur (there are guesses between 400,000 to 800,000)
- There was no proper map of the city or the areas of tax collection
- The tax collectors (Revenue Inspectors) had minimum training to use any computer assisted methods
- The present assessment method was extremely tedious and resulted in a growing number of un-assessed property, hence no tax could be issued

It was decided that a change to a revised practice needs to be implemented. In order to get the revenue collection on a systematic track it was necessary to agree on the following:

- a new base map is needed to make it possible to identify all tax paying units (houses)
- a method of identification of the tax paying units needs to be developed
- a supporting Geographical Information System (GIS) needs to be developed
- the revenue collection (operated by some 120 Revenue Inspectors) needs to be re-organised to utilise the GIS application
- the staff needs to be trained to utilise the new system

In India it is impossible to fly aerial photos over urban areas. Thus a conventional method of preparing a base map was adopted. A local Delhi based mapping company was selected through a bid competition to prepare a ground survey based map (equivalent to1:1,000 scale) over the central part of Kanpur (originally 100 sq. km, later additional 40 sq. km was added). The company used about 10 months to prepare the map and convert it into GIS compatible format.

The steps of SLIM based tax collection system in Kanpur were as follows:

- First mission to Kanpur July 2000
- Mapping started August 2000
- Needs analysis and logical system design in September 2000
- Legal framework in September-October 2000
- Elections in UP State in November 2000 - change of top management of KNN (caused a 4 months delay in decision making)
- Detailed systems design in May 2001
- Digital maps ready in July 2001
- Establishment of GIS Centre in July 2001 (Zone 5)
- GIS Centre fully operational in December 2001 (Zone 5)
- First year of full revenue collection 2002

The ICDP project Phase 2 has been a major undertaking in the city of Kanpur. It started already in 1998 and will end in December 2001. The financing has come through the Government of the Netherlands. The total budget of the project was USD 2.7 million. The

total input of GIS development work so far has been only USD238,000 out of which USD 126,000 was used for the surveying and conversion of the data in GIS compatible digital map.

There are definite benefits of adopting the SLIM approach in Kanpur. If the preliminary information proves to be accurate there will be approximately 50 per cent tax net coverage in the city. This means that the following calculation could be made:

- Year 1999-2000 Budget for KNN – USD 18 million
- Tax revenues 19% of the budget – USD 3,42 million
- GIS total solution over 5 years – USD 2,9 million
- If the tax net coverage is 50% - additional income USD 3,42 million after the first year of GIS operations

BIOGRAPHICAL NOTES

Ian Corker is a Chartered Surveyor, Town Planner and Arbitrator with over 25 years experience in urban and rural development in Africa, the Caribbean, Asia and the Middle East.
He initially worked on rural development projects in Zambia and Tanzania where he developed a system for modelling the human carrying capacity of villages in Tabora Region of Tanzania. He then moved to the Caribbean, initially to Montserrat to advise the Land Development Authority. Then to Nevis, where he established the Land Development Corporation and produced the island's first development plan, and finally to Anguilla, where he worked as Director of Lands and Surveys and Registrar of Lands for almost five years. In addition he conducted consultancies on other Caribbean countries, including St Vincent, Barbados and Guyana.
In 1997 he worked on large farm restructuring in the Ukraine. In 1998 he managed the Palestine Finland Land Management Project. The main objective of which was registration of 7,000 ha of land in the Gaza Strip that was not registered during the British Mandate Period. The law of registration was essentially the British Colonial law, as used in Africa and in the 1970's the Caribbean. In addition to registration, to the work on registration the project provided institution building in the West Bank and Gaza. Mr Corker also worked on the development of a GIS, mainly for property taxation in Gaza City.
In 2000 Mr Corker Managed a project in Vietnam with the aim of improving the administration of HoChiMinh City's land administration system.
For the last two years Mr Corker has been developing the SLIM (Systematic Land Administration System) for Soil and Water Ltd. The aim being to provide a simple and robust approach to property tax assessment for use in developing cities..

Jukka Nieminen is a GIS specialist and urban planner with over 25 years experience in urban development in Europe, Africa, Asia and the Middle East.
He initially worked with urban and regional planning in Finland (1973-82) where he took interest in the use of microcomputers in physical planning activities. He then moved to Saudi Arabia (1982-85) to do regional planning and to develop microcomputer based

applications for the Al Baha Principal Emirate and the Ministry of Municipal and Rural Affairs (Riyadh).
In 1988 Mr. Nieminen joined the UNCHS (Habitat) as Special Adviser in Data Management. In this capacity he was responsible for data advisory activities and development of microcomputer based applications for the human settlements till the end of 1995.
In 1996 Mr Nieminen joined a private Finnish consulting company where he is in charge of international GIS activities, disaster management, and R&D on GIS applications in the developing countries. The development of SLIM and FAST MAP approaches have been an integral part of his responsibilities.

CONTACTS

Ian Corker
Soil and Water Ltd.
Coppett View Cottage
Goodrich
Ross on Wye
Herefordshire HR9 6HU
UNITED KINGDOM
Tel. + 44 1600 890 322
Email ian.corker@soilandwater.co.uk

Jukka Nieminen
Vice President – GIS Consulting and Spatial Planning
Soil and Water Ltd.
Jaakonkatu 3, PO Box 50
FIN-01721 Vantaa
FINLAND
Tel. + 358 9 682 6659
Email: jukka.nieminen@poyry.fi

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ii Kelly, Roy. 1999b. "Designing Effective Property Tax Reforms in Sub-Saharan Africa: Theory and International Experience." Unpublished paper prepared for USAID Equity and Growth through Economic Research (EAGER), Bureau for Africa, Office of Sustainable Development, Strategic Analysis Division.

iii The property tax base under an ad valorem system is the total value of the properties that are defined as liable for taxation. The property tax base for an area-based tax would be the total area of property that is defined as being taxable.

iv In simplest form, the tax rate structure would be an average uniform rate applied to the potential tax base. However, the tax rate structure in the real world can be designed either as a uniform rate or a classified rate—which would tax property differentially depending on property tenure, ownership or use.

v The Valuation Ratio measures the accuracy of the overall valuation level (i.e., what percent of market value is being captured through the valuation process). In contrast, the relative accuracy of the valuations is measured by the coefficient of dispersion (i.e., the dispersion around the median).

vi The Collection Ratio measures the efficiency of the revenue collection. It is possible to break the Collection Ratio into two components: Collection Ratio on current liability and Collection Ratio on outstanding liability. The Collection Ratio on outstanding liability could be referred to as the Enforcement Ratio.

vii If government land and property is exempted from tax then it tends to be used inefficiently and there is a risk that people will take advantage of the government exemption by using tax free land for private purposes. A better way would be to work on the basis that all land is taxed, but give certain genuine government users an exemption. For example schools would be taxed, but the tax can be waved if the school can prove that its buildings are all used for state education purposes.